TFE/STAINLESS STEEL EXPANSION BEARING UNITS

ELASTOMERIC PAD

- The elastomeric pad shall be designed as a Pinned Bearing. Refer to the design guidelines of Article 14.7.5 & 14.7.6.

PTFE

- The PTFE shall be designed in accordance with AASHTO Article 14.7.2.
- The PTFE shall be virgin, unfilled sheets and recessed for one-half its thickness.
- The sheets may be either rectangular or circular. Circular sheets may provide easier fabrication for milling the recess.

STAINLESS STEEL SHEET

- The thickness of the stainless steel mating surface shall meet the requirements of AASHTO Article 14.7.2.3.2.
- Seal weld the stainless steel sheet to a ⅜" steel plate.
- The ⅜" steel plate shall be the same dimension as the sole plate.
- The ⅜" steel plate/stainless steel sheet unit shall be attached to the sole plate with stainless steel cap screws.
- Length = Width of bottom flange of the girder + 2½".
- Width = Elastomeric pad length + total temperature movement + Δ_r + 2".
- Δ_r is increase in the length of the bottom flange due to the girder end rotation under dead load.

Simple Span, One End Pinned: $\Delta_r = 6.4 * DL * Y_b / L$

DL = maximum dead load deflection at midspan (inches)
L = span length (inches)
Y_b = distance from the neutral axis of the noncomposite section to the bottom of the girder (inches)

Continuous Span: $\Delta_r = 1.6 * DL * Y_b / L$

DL = maximum dead load deflection in the end span (inches)
L = distance from the centerline bearing to point of maximum dead load deflection (inches)
Y_b = distance from the neutral axis of the noncomposite section to the bottom of the girder (inches)

SOLE PLATE

- The minimum thickness shall be ¾".
- The top surface that bears against the girder flange shall be tapered for the longitudinal slope of the girder.
- Length = width of bottom girder flange + 3".
- Width = Elastomeric pad length + total temperature movement + Δ_r + 2½".

STAINLESS STEEL CAP SCREWS

- The cap screws shall be installed parallel to the edge of the bottom girder flange and equally distributed on each side.
- The minimum spacing for the cap screws is 3" and the maximum spacing shall not exceed 5".
- Cap screws shall be ¼"-20 UNC x ¾" 82º hexagon socket flat countersunk head cap screw 18-8SS. The cap screw size is limited to ¼" diameter due to the depth of the countersunk head and the thickness of a 10 gage stainless steel sheet.
- The minimum number of cap screws required is calculated as follows:

$$\text{Number} = \frac{\text{FS * coef friction * Dead Load}}{\text{Screw thread area * allow shear stress}}$$

Dead Load = dead load reaction (kips)
FS = factor of safety = 2.0
Coefficient of Friction = value for TFE/stainless steel without silicone grease.
Screw Thread Area = root area for ¼" cap screw = 0.027 in^2.
Allowable Shear Stress = 0.75 * 80 ksi = 60 ksi

ANCHOR BOLTS

- The minimum size for anchor bolts shall be 1" diameter. 1½" diameter anchor bolts are recommended.

- Anchor bolts shall be designed to resist a horizontal seismic force in accordance with AASHTO Article 3.10 for the seismic category at the bridge site.

MASONRY PLATE

- The masonry plate shall be ¾" minimum thickness.
- Length = Length of the restraint angle.
- Width = Width of bottom girder flange plus twice the length of the bottom leg of the restraint angle + ¼".
- Bolt holes shall be the bolt diameter + 1/8".
- The masonry plate is optional for smaller girder reactions; this will need to be determined on a case-by-case basis. When the masonry plate is used, it shall be securely attached to the concrete surface, normally by bolting.

SOLE PLATE CONNECTION

- A 1/4" fillet weld using an E-70 electrode is used to connect the sole plate to the girder.

- The length of weld required = $\dfrac{\text{Max. Transverse Force}}{3.35 \text{ k/inch}}$

  E-70 ¼" weld strength = ¼"* 0.707 * 70 ksi * 0.27 = 3.34 k/inch

  The maximum transverse force shall include seismic forces.

- If the length of weld required exceeds the available weld length, the weld size must be increased.

KEEPER ANGLE (NOT FOR SEISMIC RESTRAINT)

HORIZONTAL LEG

d_H = Length of horizontal leg of the restraint angle (inches)
t = Thickness of the restraint angle (inches)
P_L = Max. Longitudinal force (kips)
F_T = Allowable tensile stress (ksi)
FS = Factor of Safety
C_W = Width of cope in the horizontal leg = 1 1/2".
∅ = Diameter of the anchor bolts (inches)

$$d_{H\ min} \geq \frac{P_L}{FS\ F_T\ t} + C_W + \varnothing$$

Minimum edge distance for anchor bolts must be checked.

VERTICAL LEG (Recommended angle size of 6"x 6" x 3/4" to start design)

d_V = Length of vertical leg of the restraint angle (inches)
t = Thickness of the restraint angle (inches)
P_T = Max. Transverse force (kips)
FS = Factor of Safety
C_H = Height of cope in the vertical leg = Sole P_L + Steel P_L + Stainless steel + PTFE + Pad + 1/4".
C_L = Length of the cope = Soleplate + T + 1".
T = Total temperature movement (inches)
F_B = Allowable bending stress (ksi)

$$d_V \min \geq C_H + \sqrt{\frac{P_T * C_L}{F_B * FS * t}}$$

LENGTH OF ANGLE

L = Length of the restraint angle (inches)
C_L = Length of the cope (inches)
H = The distance from the center of the bottom flange to the beam seat (inches)
t = Thickness of the restraint angle (inches)
P_T = Max. Transverse force (kips)
F_B = Allowable bending stress (ksi)
FS = Factor of Safety

$$W = \frac{6 * P_T * H}{FS * F_B * t^2}$$

$$L_{min} \geq C_L + 2W$$

GUSSET PLATES

When length and/or thickness of the vertical leg of the keeper angle becomes too large, gusset plates shall be designed for the keeper angle to resist bending in the vertical leg due to the transverse loading.